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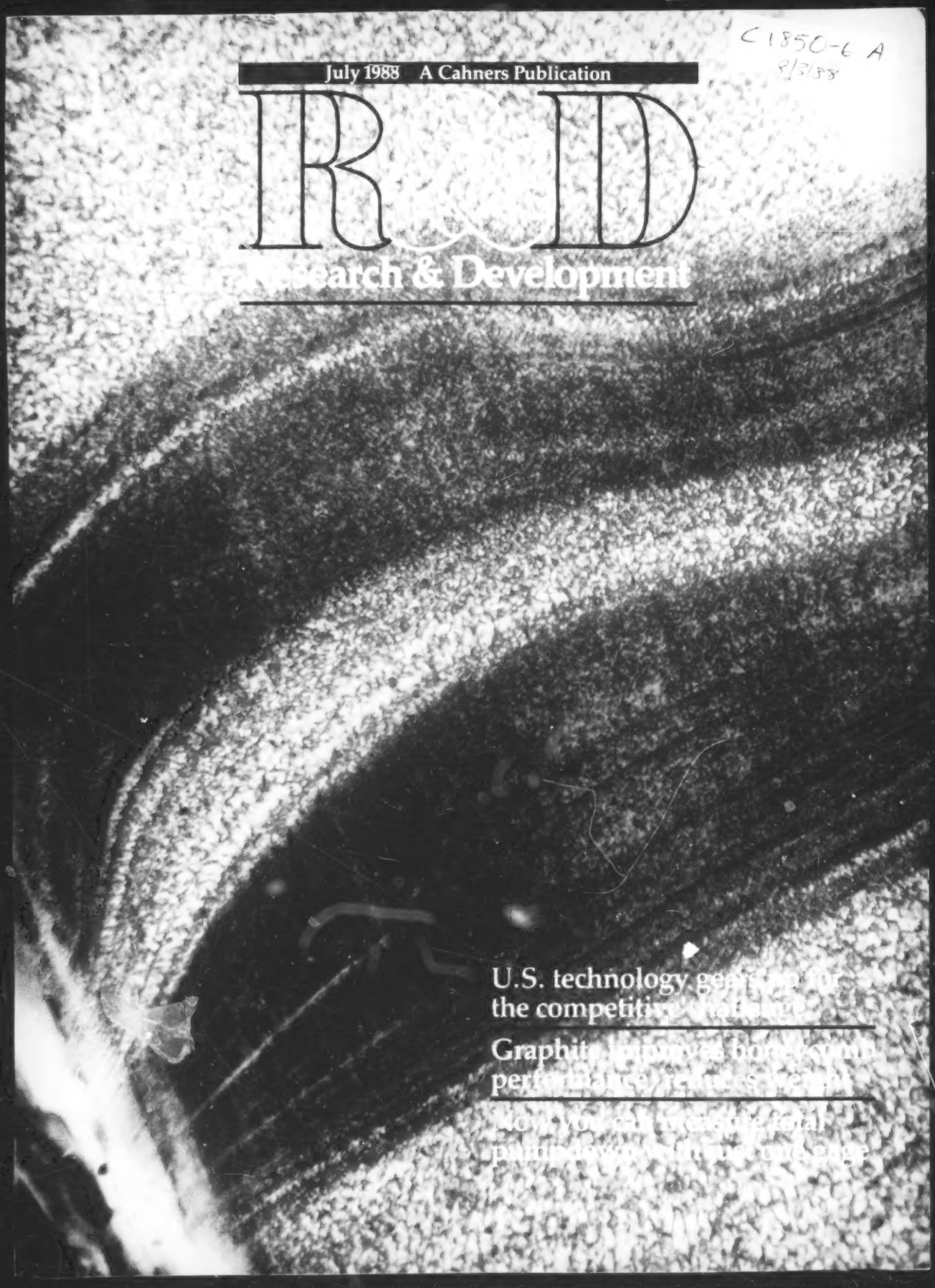
July 1988 A Cahners Publication

R&D

Research & Development



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BUSINESS

Keep U.S. competitive, R&D 2000 leaders urge

EARLIER THIS YEAR, an *R&D* poll of 500 U.S. scientists revealed that a majority (52%) believed Japan, not the U.S., would be the leader in technology by the year 2000. This reinforced a growing concern that U.S. industry was losing its edge in the race to bring innovative products to market.

Few in business or government, however, seem ready to take a leadership role on this issue. As one Washington observer put it, "Support for R&D in Congress is a mile wide and an inch deep." We also have not had an 'electrifying event"—like the launch of *Sputnik* or President Kennedy's challenge to put a man on the Moon—to rally the public to action.

Against this background, the R&D 2000 Committee was formed this past February.

R&D 2000 is a "business round table" of industry leaders dedicated to restoring America's pre-eminence in R&D and technology by the year 2000. Committee members are: Peter Browning, executive vice-president and operating officer, Continental Can Co.; Dr. Robert Fildes, president and CEO, Cetus Corp.; Dr. Joel Goldhar, professor of technology management, Illinois Institute of Technology; Dr. John Ketteringham, senior vice-president, Arthur D. Little Inc.; John Rollwagen, chairman and CEO, Cray Research; and Joseph D. Williams, chairman, Warner-Lambert Co.

The R&D 2000 Committee supports technology as the key to success in today's global economy. In the words of member Ketteringham, co-author of *Breakthroughs!*, "Technology remains the fundamental basis of economic vitality and prosperity."

While they are sanguine about America's ability to compete in technology, however, R&D 2000 members are painfully aware of the impact of increasing global competition.

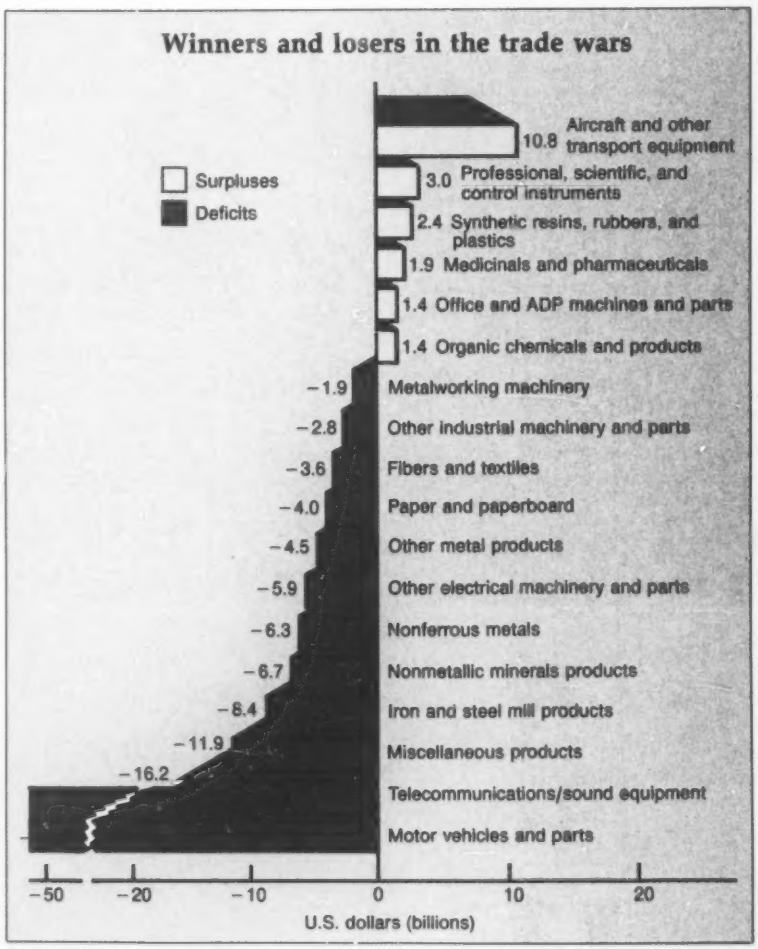
Take the case of pharmaceuticals. A decade or two ago, 80 to 90% of all new drugs were created in U.S. labs, notes R&D 2000 member Williams. Today, that figure has dropped to 60%. Warns Williams: "Relative newcomers like the Japanese are giving us and the Western Europeans a run for the money in the race to bring new drugs to the world marketplace."

In seeking to commercialize their products abroad, U.S. companies are sometimes thwarted and even barred by regulatory disparities or trade differences between countries. Says committee member Fildes, "The American market offers a level playing field to global competitors, but the reverse is not always true."

Taking a fresh approach

American companies can fight back, however, provided they consider new ways to look at their technology strategies, according to Prof. Mel Horwitch of MIT's Sloan School of Management.

Instead of wedding themselves to the model of the central R&D lab, says Horwitch, companies might distribute projects to small, decentralized research units, whether inside or outside their own walls. Instead of adopting competitive strategies with other companies, businesses might consider



***Where does your industry figure** in the U.S. trade imbalance? Aircraft exports, along with shipments of scientific instruments, played a positive role, but the automotive and metals sectors fueled the 1986 trade deficit of $130 billion.*

cooperative efforts, such as joint research ventures. Rather than relying on inventing everything themselves, companies might choose to buy innovations from others and then develop and market them.

Industry must remember, too, says Prof. Rosabeth Moss Kanter of Harvard Business School, that "R&D is not enough." To succeed in the global economy, industry must link R&D with commercialization, production, and marketing.

Kanter says that companies get the most payoff from their R&D investments when they:

- Scout ideas from many sources, including suppliers and employes who are not in R&D.
- Bring technical people closer to their customers.
- Include other functions—notably marketing—on the R&D team.

The innovation process is enhanced, says Kanter, when there are "close structural connections between potential innovators and users, between functions and departments, between the R&D project and the units that will move the model into production and use."

U.S. industry has lost substantial market share to foreign competitors not only because of declines in new product development, but also due to a slippage in quality. Nowhere has this concern been more apparent than in the automotive industry.

U.S. auto companies are, however, tackling the problem. At Ford Motor Co., says vice-president of research John P. McTague, "Quality is defined by our customers." Ford's Alpha Project, for example, is designed to bring employes and suppliers together to unleash new ideas. The company also has established a $75 million "Factory of the Future" fund for piloting new manufacturing technologies. One outcome: a fully integrated, flexible machining center designed by the engine division.

Slipping new-product innovation, declining quality control, increasing global market competition—these are among the issues confronting the R&D 2000 Committee. What about the response?

Peter Browning of Continental Can Co., an R&D 2000 Committee member.

Dr. Joel Goldhar teaches business at the Illinois Institute of Technology.

Dr. John Ketteringham looks for breakthroughs at Arthur D. Little Inc.

John Rollwagen holds the reins at supercomputer maker Cray Research.

Dr. Robert Fildes heads Cetus Corp., a California-based biotechnology firm.

Joseph D. Williams, a pharmacist, chairs drugmaker Warner-Lambert Co.

An aggressive agenda

Over the next year, the R&D 2000 Committee will be seeking ways to contribute business-oriented solutions to these problems. Included among its planned activities:

- Publication of a newsletter to a select list of CEOs, industry leaders, and government officials.
- Creation of an "R&D index" to measure R&D activity by U.S. industry.
- Formation of liaisons with such groups as the Council on Competitiveness and the Council on Research and Technology (CORETECH).
- Co-sponsorship of a national technology conference (see companion story).

But these are only pieces of a larger set of national concerns. Take the issue of technical and scientific education. Certainly the need for highly qualified scientists and engineers will not diminish by year 2000. But as R&D 2000 member Rollwagen says, "What does not appear as certain is whether enough people will be interested and educated to take full advantage of the opportunity.

"The most important thing we can

(Continued from page 16)
do," says Rollwagen, "is to promote education in the sciences and mathematics in all our schools, from elementary to postgraduate. The more people are comfortable with using the tools available today, the faster scientific discovery can progress."

Besides education, there are more-immediate issues, including:

- Consistently funding basic research, so that the U.S. does not lose its edge in that department;
- Enhancing tax and other financial incentives that promote R&D;
- Removing inefficiencies caused by government controls and legislation, especially in such key agencies as the U.S. Patent & Trademark Office;
- Providing fair treatment for U.S. companies in foreign markets.

The question remains: Will U.S. industry face up to the challenge of technological competitiveness? Some fear American business leadership might remain smug about the problem. "The biggest threat to us is that our industries, our scientists, and our technologists will wake up too late" to respond to changes in global R&D competitiveness, warns Dr. William R. Graham, science adviser to the President.

For their part, the R&D 2000 Committee members are optimistic about the nation's future. Reflecting the group's consensus, Ketteringham says that America's "Golden Age of Technology" is far from dead. "Technological breakthroughs beget additional technological breakthroughs," he says.

"Knowledge itself increases as new technological discoveries facilitate its acquisition. Progress in one generates progress in the other." □

R&D 2000 to co-sponsor technology conference

ANY STRATEGY to enhance U.S. competitiveness in global trade must find ways in which the nation's basic industries—steel, plastics, paper and pulp, automotive, etc.—can use technological advancements to reduce costs and improve productivity.

To help find solutions, the R&D 2000 Committee will co-sponsor a day-long national conference on "Traditional Industries—Innovative Research Approaches," Tuesday, September 27, in Chicago.

"In the Midwest, as on the coasts, we have research and development leading to the creation of new companies based on new products," says conference chairman Walter Massey, president of the American Assn. for the Advancement of Science (AAAS).

The difference is that in the Midwest "you have the application of *new* technologies to the traditional manufacturing backbone industries," says Massey, vice president for research and for Argonne National Laboratory at Univ. of Chicago.

The program, co-sponsored by the AAAS, is directed at industry executives, R&D managers, academic researchers, and government lab administrators.

The opening session will examine the industrial economy of the Midwest and explore new forms of collaboration that are developing among industrial firms, universities, private labs, and Federal facilities. These "linkages" include incubator facilities, venture capital funds, research parks, and government commissions.

The central part of the day will be devoted to a set of workshop sessions, each of which will examine a real-world case of collaboration between industry and university, government, or independent research facilities. The workshops will be run twice, so that participants will be able to attend two different presentations.

The afternoon session will consider lessons learned from experiences in collaboration among the industrial, academic, and independent or Federal laboratory partners. A representative from industry will guide academicians and government lab officials on how to work with the private sector, while a public-sector speaker will advise industry executives on how to work with academia and government labs.

Dr. John Ketteringham, senior vice president of Arthur D. Little Inc. and author of *Breakthroughs!*, will close the day with a talk on "What to Do Next: Guidance for Policymakers."

Registration is $120 per person in advance, $135 at the door. Special room rates at the Hotel Nikko, 320 N. Dearborn, Chicago, are available.

For more information, contact Dr. Albert Teich, AAAS, 1333 H St. NW, Washington, DC 20005, 202/326-6600; or Rob Cassidy, R&D 2000, 312/390-2771. □

Analytical instruments: slowdown in growth

SHIPMENTS of analytical instruments will grow 7.4% a year through 1995, a marked downturn from the 11.5% annual growth recorded from 1977 to 1986. By the mid-1990s, the analytical instruments market will reach $4.3 billion.

Those are the major findings of a recent study by the Freedonia Group, a Cleveland, OH, research firm. The report cites cutbacks in both Federal and private-sector R&D spending as the reason for the decline.

The strongest long-term growth opportunities for analytical instrument makers over the next decade: pharmaceuticals, biomedical research, and environmental science. Spectroscopy instruments and separations systems will each have about $1.7 million in sales by 1995.

The analytical instruments market in the metals, energy, and semiconductor industries will decline over the short term due to depressed conditions in those sectors.

For more information, **circle 850** on the Reader Service card. □

Engineers tackle specialty certification

ENGINEERS recently took a small step toward greater professionalism, when 130 engineers from 23 membership societies held the first conference on specialty certification.

"It's something that has been brewing for a number of years, and it's just happening now," said Arthur Schwartz, general counsel for the National Society of Professional Engineers.

A few specialty societies, including the American Academy of Environmental Engineers, the Society of Manufacturing Engineers, and the American Society of Safety Engineers, already have certification programs, said AAEE past president Louis Guy.

"The problem is that the professional engineering license does not indicate whether the person is qualified in any specific branch of engineering," said Guy.

Individual societies now must decide whether to require certification.

"It has taken the medical profession close to 100 years to get where it is in certification, and it's going to take engineering a long time to grapple with the issue," said the NSPE's Schwartz. **R&D**

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Research & Development (ISSN 0746-9179) is published monthly except semi-monthly in March by The Cahners Publishing Company, A Division of Reed Publishing USA, 275 Washington St., Newton, MA 02158-1630. Terrence M. McDermott, President; Robert T. Brawn, Group Vice President; Jerry D. Neth, Vice President/Publishing Operations; J.J. Walsh, Financial Vice President/Magazine Division; Thomas J. Dellamaria, Vice President/Production and Manufacturing.; Timothy M. Kelly, Vice President and Publisher; Neil P. Ruzic, founder of *Industrial Research*.

Circulation Records are maintained at Cahners Publishing Company, 44 Cook St., Denver, CO 80206-5191 (Phone: 303/388-4511). **Circulation:** More than 115,000 copies distributed. Second-class postage paid at Denver, CO 80206-5191, and at additional mailing offices. **Postmaster:** Send address corrections to *Research & Development* at our Denver address.

Subscriptions: Annual subscription rates for non-qualified people: USA, 1 yr $40; Canada, Mexico, and foreign via surface mail, 1 yr $55; foreign via air mail, 1 yr $100. Except for special issues where price changes are indicated, single copies of regular issues are available for $10. Please address all subscription mail to *Research & Development*, 44 Cook St., Denver, CO 80206-5191. Include zip code and—for change of address—copy of old label.

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New polypeptides respond to chemical potential changes

Use ion mobility spectrometry for detection in low ppb

Now, vacuum pumping system gives 6 x 10 torr oil free

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Look beyond the lab for sources of innovation

ERIC VON HIPPEL has a message for U.S. manufacturers: Don't rely solely on your in-house research labs to come up with product innovations. Open your eyes, says von Hippel, to sources of innovation you may never have dreamed of—your suppliers, your sales staff, your customers, even your competitors.

Von Hippel, a professor of technology management at MIT's Sloan School of Management, argues in a new book, *The Sources of Innovation* (Oxford University Press), that manufacturers too often assume—incorrectly, as it happens—that product innovations must be developed by industry. In doing so, they may mismanage their R&D efforts and lose their competitive edge.

"You have no hope of managing the innovation process well unless you know what the source of innovation is," he told *R&D* in a recent interview at his Boston apartment.

After more than a decade of research and personal experience as cofounder of a high-tech firm, von Hippel has found that the sources of innovation vary from industry to industry.

In the plastics field, for example, he has found that 9 of 10 new products are still developed by manufacturers. But in scientific instruments, three out of four innovations are developed by users. And in the manufacture of wire termination equipment, more than half the new ideas come from suppliers.

"I got interested in this problem around 1975," says von Hippel. "I kept seeing stuff coming out of R&D labs, and it worked, but I kept wondering if anybody needed it."

So he began a systematic study of user needs, starting with the analytical instruments field. To his own surprise, he found that customers not only knew what they needed but had found ways to adapt the manufacturers' equipment to meet their needs. In fact, nearly four out of five product innovations were being developed by customers—an unusually strong pattern, according to von Hippel.

Von Hippel tried to come up with a theory to account for these huge differences between user innovation and manufacturer innovation in the scientific instruments field. His answer: "economic rents," which he defines as "the extra profit you get for being an innovator."

In simple terms, he found that users of scientific instruments were finding it profitable to spend their time fiddling with the equipment in order to make it work more efficiently and economically.

At this point in his research, von Hippel had a new problem to address: How could manufacturers of scientific instruments manage the process of innovation and capture the economic rents—those extra profits attributable to innovation—for themselves, rather than letting their customers keep all the benefits? Or, as he puts it, "How could you manipulate the incentives?"

Von Hippel hit pay dirt in the field of automated clinical chemistry analyzers, where three companies—Technicon, Abbott, and DuPont—were competing. Von Hippel noticed that there was an important design difference between analyzers made by Technicon and Abbott and those made by DuPont.

The first two had an "open architecture," with the functional modules connected by plastic tubing and the reagents placed in bulk reservoirs and metered into the system as needed. DuPont had a closed system. "You couldn't get at the inner workings, and the reagents came in factory-sealed test packs," says von Hippel.

Referring to the Technicon analyzer, von Hippel says, "The lab people would get in there and rip out the tubing and rig it all up to do tests it wasn't originally designed to do. Then they'd start messing with the reagents." Because the DuPont system was harder to customize, lab workers couldn't fiddle with it—and few innovations resulted.

Technicon went one step further, von Hippel notes. It sponsored a journal in which it published descriptions of the innovations—much as computer "user groups" share information through electronic bulletin boards. That gave customers an incentive to reveal the changes they had made to the equipment—innovations the company was then able to incorporate into the product.

DuPont had to bear the cost of new-product innovation alone, while Technicon was able to get its customers to share a portion of the expense.

The MIT professor also found that identifying what he calls "lead users" of a product or process can be crucial

1987's Big R&D spenders

1987 Rank	1986 Rank		
1	1	General Motors	4,361
2	2	IBM	3,998
3	3	Ford Motor Co.	2,514
4	4	AT&T	2,453
5	6	DuPont	1,223
6	5	General Electric	1,194
7	10	Digital Equipment	1,010
8	7	Eastman Kodak	992
9	9	Hewlett-Packard	901
10	8	United Technologies	879
11	11	Boeing	824
12	12	Chrysler	798
13	13	Xerox	722
14	15	Dow Chemical	670
15		McDonnell Douglas	648

Source: Standard & Poor's Compustat Services, Inc.

As in 1986, General Motors, IBM, Ford Motor Co., and AT&T topped the Business Week *list of R&D spenders among U.S. industrial companies. A record $54.3 billion was spent by 915 companies in 1987—more than in 1986, but less than 4% when adjusted for inflation.*

R&D

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*Domestic

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Research & Development (ISSN 0746-9179) is published monthly except semi-monthly in March by The Cahners Publishing Company, A Division of Reed Publishing USA, 275 Washington St., Newton, MA 02158-1630. Terrence M. McDermott, President; Robert T. Brawn, Group Vice President; Jerry D. Neth, Vice President/Publishing Operations; J.J. Walsh, Financial Vice President/Magazine Division; Thomas J. Dellamaria, Vice President/Production and Manufacturing.; Timothy M. Kelly, Vice President and Publisher; Neil P. Ruzic, founder of *Industrial Research*.

Circulation Records are maintained at Cahners Publishing Company, 44 Cook St., Denver, CO 80206-5191 (Phone: 303/388-4511). **Circulation:** More than 115,000 copies distributed. Second-class postage paid at Denver, CO 80206-5191, and at additional mailing offices. **Postmaster:** Send address corrections to *Research & Development* at our Denver address.

Subscriptions: Annual subscription rates for non-qualified people: USA, 1 yr $40; Canada, Mexico, and foreign via surface mail, 1 yr $55; foreign via air mail, 1 yr $100. Except for special issues where price changes are indicated, single copies of regular issues are available for $10. Please address all subscription mail to *Research & Development*, 44 Cook St., Denver, CO 80206-5191. Include zip code and—for change of address—copy of old label.

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Vacuum show issue, 1988 symposium preview

New SEM without sample preparation or artifacts

Bring computer power to surface analysis systems

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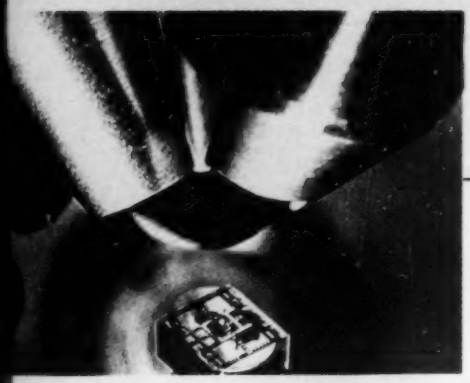

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***Vacuum chamber** of "SIMSLAB" with sample in place for analysis leads readers to page 105 and our preview of the upcoming 1988 AVS symposium and exhibition. Photo courtesy VG Ionex Ltd.*

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